bers of these classes at graduation and at their entrance into the College.

The line *a b* indicates what might have been expected had no such radical and unprecedented increase of the demands at entrance been made. The College would, at its then rate of growth, have attained a census of 1,000 students in 1898 or 1900, possibly 1,200 in the latter year. Numbers were then restricted by thus cutting the expectant entrance-class in half and its numbers fell as shown, and the dotted line, *c d*, indicates where the figures will probably reach, at those dates, as now thus reduced. Similarly, the lines *f h* and *g i* show what numbers were promised, between the specified dates, under the one, and what under the later, arrangement. The lines *j k* and *l m* show what should have been and what actually will probably be the magnitude of the graduating classes, in 1898 to 1900, inclusive. The line *D* indicates the number of students taking the Master's degree. The peculiar 'hump' at the date '89, on *B*, indicates the effect of the unsuccessful attempt to restrict numbers at that date by limiting the number accepted.

Just what is to be considered the real balance between advantage and disadvantage due the noted elevation of the entrance requirements, in '94, is perhaps difficult to decide. It has given a vastly better course; but the difference between the lines *a b* and *c d* shows that the College has lost the opportunity to benefit many hundreds of students who have, as it is, been compelled, in most cases, probably, to go into business without professional training and who are thus placed almost hopelessly in the rear of their more fortunate fellows in their struggle for success through life.*

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UNIVERSITY, January 2, 1898.

* Proceedings Society for Promotion of Engineering Education, 1898.

MECHANICAL ILLUSTRATION OF KIRCHOFF'S PRINCIPLE.

IN teaching the reversal of the metallic lines in the Fraunhofer spectrum it is often difficult for the student to get a concrete idea of the principle that a molecule or atom will absorb especially radiant energy whose period is identical with the inherent period of the molecule itself.

A customary method of illustrating this point is with two tuning forks upon resonance boxes, but this requires very careful manipulation and is not altogether satisfactory. The following method has proved quite satisfactory:

The suggestion of Lord Kelvin for a mechanical illustration of a molecule having inherent periods of vibration is used, replacing his spherical shells by rings. Such a molecule with one rate is shown in Fig. I.

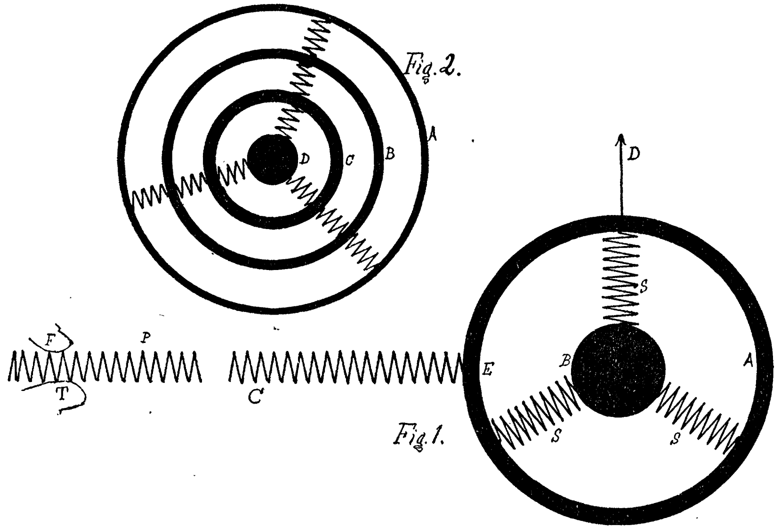
The ring *A* is about 20 cm. in diameter and made of brass rod about 1 cm. in diameter; the ball *B* is preferably somewhere near the same mass as the ring *A*. The three spiral springs *S* are wound about 2 cm. diameter of about No. 22 hard brass wire.

Such a molecule has a rate of vibration of about 4 or 5 per second when suspended on a long string as at *D*. A close spiral spring *C*, similar to *S*, but about 50 cm. long, is attached to the ring at *E*, the other end being held between the thumb and finger at *TF*.

While holding this spring slightly tense it can be set into longitudinal stationary waves by compressing the part at *P* toward *TF* and then letting go. The period of these vibrations depends upon the length *TF* to *E*. Commencing with this length about 15 to 20 cm., it will be observed that the stationary waves in *C* do not effect the molecule. Taking *C* longer and longer a point is reached where the waves in *C* are taken up and a decided vibration is set up between *A* and *B*. That is, the molecule absorbs the energy from *C* when its period

is the same as its own inherent period. If the length of C be now slightly changed, the phenomenon of beats is readily apparent.

An electric arc will throw a sharp shadow of this apparatus upon a screen and make the experiment visible to a large audience. The spring C may be replaced by an electrically excited tuning fork or other mechanical appliance.



The armature of a small electro-magnet may be attached to the ring at E and the current interrupted by some mechanical circuit breaker whose rate can be varied.

A molecule like Fig. 2 would have several inherent rates depending upon the relative masses of A, B, C, D and upon their connecting springs. Ingenuity will suggest many variations or improvements upon these suggestions.

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PLASTILINE, A NEW MODELING COMPOUND.

PALEONTOLOGISTS have constantly to deal with organic remains preserved in the rock in the form of natural casts, molds and impressions, for the proper study of which it is indispensable to take reverse casts or impressions. The materials commonly used for this purpose are beeswax (either pure or mixed with some stiffening substance, such as ozocerite or paraffine), dentists' modeling composition (which must first be softened in water heated nearly to the boiling point), glue, gelatine, melted sulphur, and, of course, the common plaster of paris. One writer* has suggested the use of tinfoil for taking repoussé impressions, the foil being afterwards coated with varnish to insure retention of its shape.

Each of the above-named substances has its own special advantages and applicability in certain cases. But a comparatively new plastic material which is especially well adapted for modeling purposes, and hence is of interest to the taxidermist, cartographer and others, is that known as *plastiline*. This is the invention of Professor Luighi Giudice, of Genoa, Italy, by whom it has recently been perfected, and is,

* Goodchild, H. G., How to take Impressions of Fossils (Geol. Mag. [3], Vol. IX., p. 206), 1892. See also, for various hints on modeling: Osborn, H. F., Models of extinct Vertebrates (SCIENCE, Vol. VII., p. 841), 1897. Davis, W. M., and Curtis, G. C., The Harvard Geographical Models (Proc. Boston Soc. Nat. Hist., Vol. XXVIII., p. 85), 1897.